

## IMPROVING THE TECHNOLOGICAL CAPACITY OF THE LOCAL CONTRACTORS THROUGH e-BUSINESS TECHNOLOGY TRANSFER – THE CASE OF THE LOCAL GHANAIAI CONTRACTORS

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### ABSTRACT

Technology transfer (TT) within construction has emerged as an important business activity across many developing countries across the globe including Ghana. For several years TT from developed countries has been viewed as a key element in addressing the low levels of technological development and know-how in developing countries construction industries. TT according to many writers and researchers involve mostly cross-border initiatives with the main purpose to improve the capacity of the local contractor. This paper therefore, considers TT as a mechanism for improving the capacity of the local contractor in developing countries. In this regard, TT could be viewed in the form of knowledge (soft technology), skills and tools (hard technology) which usually come from developed countries to developing countries through construction project activities. Therefore, the objective of this paper is to assess the influence of foreign contractors in supporting transfer of e-business technology to the Ghanaian construction industry. In view of this, a total number of five (5) semi-structured interviews were conducted as follow: one (1) foreign firm, two (2) expert interviews and two (2) local contractors (collaborators) representing one case study out of a total of three. This research involved an interpretivist approach based on qualitative data in order to have an in-depth understanding of the objective of this paper and have insight into how practitioners perceive the roles of foreign contractors in the transfer of e-business technology to improve performance in the construction industry in Ghana. This paper reports that content analysis shows the important role that foreign contractors play within the context of e-business technology transfer. The results also show that foreign firms undertake TT in an *ad hoc* manner and this exercise need to be streamlined. They further indicate several arguments on the need to address the identified barriers to enable the industry to harness the full potentials of e-business.

**Keywords:** e-Business technology, technology transfer, construction industry, developing countries, foreign firms,

## **INTRODUCTION**

According to Ayarkwa *et al.* (2010), the Ghanaian construction industry is characterised by multiple of small firms consisting of 1-60 employees. The industry had an estimated employment figure of 2.3% of the economically active population (Amankwa, 2003). It is noted that small construction firms are of strategic importance to employment and wealth creation in the Ghanaian economy (Dansoh, 2005). However, the Ghanaian construction industry is experiencing serious problems in respect to low productivity, lengthy pre-contract award procedures, corruption and delays resulting in time and cost overruns (Ahiaga-Dagbui *et al.*, 2011). Ayarkwa *et al.* (2010) identified low technology capability. Similarly, (Ofori, 2012) note poor communication structure as one of the nagging problems confronting local contractors and the entire construction industry in Ghana. These identified problems are only likely to get worse if not checked and addressed. For government to achieve its agenda of delivering strategic infrastructure to meet Ghana's low middle-income status, there is a need for strategies to be put in place to address these identified problems immediately.

One innovative way to address these problems is through e-business technology transfer to the local contractors within the construction industry in Ghana. E-Business has the capability to enhance inter and intra organisation communications thus, eliminating problems connected to communication among key project partners. Timely communications essentially can address low productivity, lengthy pre-contract award procedures and delays thereby eliminating time and cost overrun issues. E-business minimises face-to-face contacts with government officials thereby preventing corruption in contract award process. Further, benefits like reduction of manual work and contract-related papers, routine administrative processes become simpler after some initial adaptation and training and reduction in contract processing time. These are key benefits that can be derived through the introduction of e-business to the Ghanaian construction industry.

This research was developed to assess the influence of foreign contractors in supporting transfer of e-business technology to the Ghanaian construction industry. The paper first presented a brief literature review followed by the research method adopted. It then presented findings of the research based on the themes technology, organisation readiness and continuous skills development. The paper concluded by providing future research direction.

## **e-BUSINESS LITERATURE AND PRACTICE**

In recent years, the use of Internet technology for business has been on the increase mostly across manufacturing, retail, banking and many other business sectors. The benefits of using Internet

technology to conduct business have been well noted and researched, the emergence of Internet technology has far-reaching ramifications on the way business is conducted (Gunasekaran and Ngai, 2008). This act of conducting business using Internet technology in conjunction with ICT infrastructure is referred to as electronic business (e-Business) and in some research documentations it is also referred to as electronic commerce (e-commerce). In contrast Ahmed *et al.* (2005) believes that e-business is an umbrella terminology that encompasses e-commerce and e-procurement activities and refer to the utilisation of network computing and the Internet to transform a firm's value chain (i.e. internal processes, suppliers and partner interaction, and customer relationships with the prime goal of creating value and competitive edge). From the work of Damanpour and Damanpor (2001), they are of the view that e-business and e-commerce is any "net" business activity that transforms internal and external relationships to create value and exploit market opportunities driven by new rules of the connected economy. Similarly, e-commerce is referred to as business transaction by electronic means through the Internet and/or dedicated networks (Anumba and Ruikar, 2002, Ahmed *et al.*, 2005). According to Damanpour and Damanpor (2001), The Gartner Advisory Group, a research and advisory services firm, describes e-business in terms of a quantity rather than an absolute state of a company. They consider a business an e-business to the degree that it targets the market opportunities of conducting business under new electronic channels, which revolve around the Internet. This is an acknowledgement that e-business comes in many forms and can be implemented to a very small or large degree. It is also an acknowledgement that the "Internet" and the "Web" are essential components of e-business and e-commerce strategies and activities. Fundamentally, e-business can be described as the interchange of goods, services, property, ideas or communications through an electronic medium for purposes of facilitating or conducting business (Costello and Tuchen, 1998) cited in Cheng *et al.* (2001).

Laudon and Laudon (2002) cited in Ruikar and Anumba (2008) emphasised the use of the internet and other digital technology for organisational communication, coordination and the management of the firm. On the other hand, Wamelink and Teunissen (2003) studies on e-business have adopted the use of information and communications technology to change and improve business relationships as a primary measure. In the simplest possible term, however, e-business is an electronic way of doing business (Ruikar and Anumba, 2008). Therefore, companies must participate in external business relationships by using computer interactions (i.e. transactions, support, marketing, communication and collaboration) by either business-to-business (B2B) or business-to-consumer (B2C), if it is to be considered an e-business (Damanpour and Damanpor, 2001). In relation to this, Cheng *et al.* (2001) argue that e-business infrastructure is used to improve communication and coordination, and encourage the mutual sharing of inter-organisational resources and competencies. This was further corroborated in a general perspective by Muffatto and Payaro (2004) arguing that e-business is the

process whereby Internet technology is used to simplify certain company processes, improve productivity, and increase efficiency. It allows companies to easily communicate with their suppliers, buyers, and customers, to integrate “back-office” systems with those used for transactions, to accurately transmit information, and to carry out data analysis in order to increase their competitiveness. To support the inter-organisational sharing of resources and competencies in a network structure, communication and co-ordination need to be maintained (Cheng *et al.*, 2001).

## **e-BUSINESS IN CONSTRUCTION**

As indicated in literature, e-business potentially can be deployed and applied across all economic sectors and non-economic activities. According to Hashim and Said (2011), few writers described e-business in a broader context; that is ‘the facilitation and integration of business process’. However, in construction industry specifically, London *et al.* (2006) provide an extensive definition of e-business in the context of construction industry as reported by Hashim and Said (2011):

*“E-business in construction involves any electronic exchanges of information in relation to the various stages of the design, construction and operation asset life cycle which includes:*

*Internal organisational driven activity for firm core and support business including industry specific and generic business software applications, websites, email and electronic banking.*

*Externally linked online web based portals involving:*

- *Design collaboration and document management*
- *Online tendering*
- *Procurement, purchasing and invoicing*
- *Information*
- *Online or internal organisational facility management systems”.*

It can be deduced from the discussions that there is no conclusive definition for both e-business and e-commerce. It showed that definitions are adopted based on the particular sector in question or where a particular research is being carried out. In this context, the definition provided by London *et al.* (2006) is relevant as it encompasses all the component identified in the discussion.

## **BENEFITS OF e-BUSINESS IN CONSTRUCTION**

Assessment of academic literature identified the following common e-business barriers and benefits to construction. Low levels of e-business implementation within construction has been highlighted despite numerous benefits to the construction industry (Ruikar and Anumba, 2008, Eadie *et al.*,

2010a, Eadie *et al.*, 2010b, Perera *et al.*, 2011). Similar work done by Isikdag *et al.* (2011) from developing country perspective, highlight barriers such as technological infrastructure, security, lack of basic ICT skills and difficulty in reengineering of business process to support e-business activities. Najimu (2011) identified among other things, a lack of skills, training and security as barriers within the construction industry in Nigeria. This is as a result of the fragmented nature of the construction industry and the one-off nature of its products (Ruikar and Anumba, 2008). For example, Oyediran and Odusami (2005) note that one important benefit of e-business to the construction industry is the removal of geographical boundaries within the global construction environment. Ruikar *et al.* (2003) are of the view that the simplified business processes provided by e-business through ICT has significantly impacted the construction industry in many ways. The emergence of e-business in construction in most cases developed economies shows there is sufficient evidence of e-business activities such product promotion, service promotion, e-procurement, project management, project collaboration and online tendering within construction (Issa *et al.*, 2003, Alshawhi and Ingirige, 2003, Ruikar and Anumba, 2008).

The study is about e-business technology transfer from foreign contractors to local contractors in Ghana. To take this study forward a detailed literature review and synthesis was carried. The parameters arrived at for e-business technology transfer in the context of this research is as follows: Technology; Organisation readiness and Continuous skills development.

## **THE PROJECT – CASE STUDY FOR e-BUSINESS TECHNOLOGY TRANSFER**

This project is a 12km first class road project comprising a three (3) lane dual carriage way, two (2) over pass and one (1) under pass. In addition to the main project, pedestrian foot bridges located at four (4) different locations shall be constructed. The project is situated within a busy district in Accra, the national capital of Ghana. The main contractor is a foreign contractor and the nature of the project has necessitated project specific joint venture/collaboration between some indigenous Ghanaian construction firms for the delivery of specific contracts under the main contract. Under the terms of engagement, the foreign contractor is obliged to provide capacity training and technology transfer initiatives to the benefit of the local contractors directly or indirectly during the project period. The client (employer) is the Ghana government.

## **METHODOLOGY**

The main method for data collection was semi-structured interviews. Interviews were conducted within an on-going project (see section 5) which is referred to as case study (CS) for the purposes of this research. The interviewees were senior managers working for either the main contractor (foreign

firm) or local contractors. To gain multiple insights, two expert views were sought as part of the data collection. The first expert, an IT and procurement specialist was drawn from government procurement authority and e-governance project. This expert was selected to provide an insight into Ghana government e-governance project which has e-business component. The second expert, a foreign consultant with twelve (12) years working experience in joint venture (JV) arrangements and project development within construction, this expert provides consultancy services in respect of the case study project, as a result, was selected to provide insight into the JV as detailed in the project (see section 5). See details of category and number of organisations involved in this study in Table 1. Even though the interviews reflected a total number of five (5), they were conducted for over one-and-half hours per project staff. On the other hand, each expert interview was conducted for two hours. The interviews were conducted six (6) months into the physical implementation of the project so that a thorough assessment of capacity training and e-business technology transfer arrangement contained in the project details can be undertake as part of data collection process. The interview with the respondents was recorded using digital tape recorder based on the permission of the respondents. Following the completion of the interviews, the interview discussions were later transcribed ensuring that conversations were fully captured and also representing opinions and views expressed by the respondents. For the purposes of true reflection of respondent's opinions and views, the transcribed texts were sent to the respondents for verification. The transcribed data were subsequently analysed utilising NVivo 10 software package to filter and sort emerging themes for further analysis. As provided by the principles of using NVivo 10, the analysis started by coding of the data from a general perspective and then narrowed down through merging of similar and identified themes, concepts, ideas, topics, phrases and terms within the research area to enhance reliability and validity of the data. The final themes arrived at are technology, organisation readiness and continuous skills development.

**Table 1: Category and number of organisations involved in this study**

Description	Organisation Type	Role of Organisation	Personnel Type	Number of Interviews per Org.
CS	Foreign Firm	Main Contractor	Project Manager	1
	Local Firm	JV Partner	Project Manager	1
	Local Firm	JV Partner	Assistant Manger	1
Government Procurement Office	Ghana Gov't Procurement Office & e-governace	Expert View	IT & Procurement Specialist	1
Consultant	Foreign Firm	Expert View	Country Rep.	1

CS = Case Study

## **FINDINGS AND DISCUSSIONS**

The following are the emerged themes from the semi-structured interviews based on the objective set out in this paper.

### **TECHNOLOGY**

#### **e-Business Enabling Technologies**

The project manager of the foreign construction firm undertaking the project as the main contractor confirmed that the firm uses e-business enabling technology to support their work both locally and internationally. For example, the project manager mentioned the use of internet technology in many ways. The project manager further mentioned that ICT and the internet are used in all aspects of the work they do. Designs are done using CAD technology and distributed via internet technology to partners even locally. When further asked how the local collaborators are coping with the technological demands, the project manager says:

*“The local contractors have some challenges in the area of basic knowledge in ICT, financial issues which bother on general economic environment and the attitude of doing things the same old ways, these are key challenges the local contractors are facing”.*

The project manager further explained that the working environment appears a lot better. “We have developed continuous training programmes for the collaborators which are intended to enhance their capacity”.

#### **Project Management and Collaboration**

The project manager of one of the local contractors involved in this case study agrees that the internet indeed has played a major role in the way they conduct their activities. “Information on design issues and solutions are made available to us on timely basis for comments and suggestions”. “Often you tend to see great comments from professionals elsewhere working on another project”. For instance, when the project manager was asked to describe how the internet technology and this joint venture have enhanced their work, the following were the responses the project manager provided:

*“....this has speed up our work most especially communication process between all the parties involved in this project.”*

*“....by and large we have avoided unnecessary delay hitherto associated with construction project activities in this country”*

The second local manager expressed an opinion on how construction project is carried out in Ghana. The manager is of the view that those of them in this joint venture arrangement have improved on their capacities and also enhanced their firm's status.

*“The key challenge is updating our capacity in a country where resources are scarce.”*

## **ORGANISATION READINESS**

### **Capacity to Accept and Absorb e-Business Technology**

Under this, two (2) respondents were unanimous in their responses; actually they were clear in attributing lack of technological know-how and application to the low capacity of the firms operating in the construction industry in Ghana. “The present situation of the construction industry in Ghana needs rethinking”. A further probing of the issue, one of the local managers was asked to explain what is meant by low capacity; the participants were actually referring to barriers that affect absorptive capacity of the local construction firm. For example, the manager's views were expressed as follows:

*“...inadequate trained professional and finance are major issues within the industry and it is affecting the entire construction industry in Ghana most of the people in the industry do not use computers let alone to think about industry related software. We do not have the financial capacity to employ people with such skills”.*

It is obvious from the findings that majority of professionals in the construction industry do not have ICT skills that are required to support any attempt to computerise their works and some expressed the fear of losing their jobs in the event of any such management decision hence prefer to keep to the usual way of working.

### **Culture**

Under this, three respondents acknowledge the important role of culture. It could produce positive or negative results. For example, one of the local project managers pointed out that this joint venture exposed them to many things that have implications on their work. According to one of the local managers, most of us are identified by our work method, we use manual for everything we do, whereas the foreign firm does work in the office and on site using technology. For example a project manager from the foreign firm expressed the following views:



*“I think to move forward it is important to take on board staff of the local firm and continuously let them understand the benefits of e-Business to the company; attitude to work has to change, staff can then be encouraged to start using ICT facilities and e-Business tools.”*

*“.....by that the organisational culture will begin to change to conform to e-Business friendly environment and new identity can be found”*

*“The local firms naturally will begin to resolve challenges associated to the use of e-Business once they identify one”.*

### **Internet Infrastructure**

All the five respondents acknowledged that, the fundamental requirement for e-Business is the availability of internet in the firm. The foreign consultant observed as follow:

*“The use of the internet technology is generally gaining popularity among the local contractors however, majority of them are still unable to access it due to high cost from service providers”.*

*“Those that have it are unable to explore the innovative capacities of the internet hence the common trend of inefficient working environment the contractors operate in today”.*

### **ICT Equipment Hardware**

Again all the five respondents were emphatic in their response that ICT equipment plays a major role as e-Business depends on the capabilities of ICT equipment and the internet to provide the necessary impact. From this the foreign consultant again observed as follow:

*“The economic situation and non-availability of projects makes it difficult for contractors to invest in ICT equipment as they are not always in business. I think it is also a clear case that they lack the financial capacity to recruit qualified personnel”.*

### **Regulations**

The procurement expert from government office agreed that legal issues in e-business transactions are key to the development of a strong platform for business transactions to take place. This position was corroborated by the foreign consultant as follows:

*“From experience good legal system provides confidence for people transact business in a secure environment in addition to legal limitations that may be required”.*

### **Political Influence**

Under the political authority theme, all five respondents were emphatic in their responses by acknowledging that, political influences have had negative impact on works procurement process in the construction industry. In many instances, tenders are skewed in favour of the contractor who is able to command sufficient political influence; projects are awarded on political affiliation lines making monitoring of such projects extremely difficult. Projects are eventually given out to contractors who do not have the resources to undertake such projects. Yet, the foreign consultant thinks otherwise, political influence or intervention according to the consultant may not necessary be harmful however, the consultant agrees that:

*“there is more to be done to improve the procurement system in order to minimise human to human interface it all about getting our processes right and improve upon them”.*

The procurement expert from government office similarly thinks that political influence can be of benefit to the industry. For example, it can be exploited to restructure contractor registration framework to enable the system to allow only qualified people to enter the construction industry. The expert further expressed the following views:

*“I think industry led skills development would help the industry promote the culture of quality work, infusion of technology most especially ICT will improve the industry’s outlook and performance, political influence in my opinion could be of immense benefit” in improving our business processes”.*

## **CONTINUOUS SKILLS DEVELOPMENT**

### **Acquisition of New Skills**

When participant views were sought on sustaining the skills acquired as a result of their involvement in this joint venture, their responses did not vary as such the explanation points to the fact that they have to change their work culture gradually in order to conform to acceptable ways of doing business. The fact is globalisation and ICT have brought the business community closer than before so we cannot stay behind. Some of the proposals put forward by the participants are highlighted as follows:

*“.... to it very important to have frequent update of managerial skills that we have acquired now so that we can improve on productivity and also manage our project profitably it is the only way to become proficient (Local Project Manager)”.*

*“Basically, the main issue remain that we have to start automating our processes to conform to the use of ICT and especially the internet, so utilising ICT facilities effectively in the project management aspect should be our target. Secondly, there is the need to continuously improve on our skills through either self-learning or any other available means (Local Asst. Manager)”.*

## **CONCLUSION AND WAY FORWARD**

This research aimed to assess the influence of foreign contractors in supporting transfer of e-business technology to the Ghanaian construction industry within the context of joint venture between foreign and local contractors. This research in particular assessed the technological capacity of the Ghanaian local contractor and the influence of their foreign counterparts in transfer of e-business technology capability to the local contractors. To establish how foreign contracting firms have influenced technological and capacity development of the Ghanaian local contractors, three (3) case studies were developed within the construction industry in Ghana. The first case study was conducted, this report represent the outcome of the first case study. The results of the research show the existence of technological and skills gaps in the Ghanaian construction industry. To further analyse these key problems the main issues that emerged from the case study where discussed within the context of technology, organisation readiness and continuous skills development. Further details from the discussion of the themes revealed that for success in e-Business technology transfer, barriers such as basic ICT skills and poor financial capacity of local contractors should be adequately addressed. The notion that a minimum capability standard to absorb or assimilate e-business technologies should be derived or arrived at as part of technology transfer process remains relevant. Therefore, issues concerning technology transfer process should be done in a structured and coordinated way as part of the JV arrangement. The research show that local contractors recognised that culture plays an influential role in shaping up organisational outlook and attitude of their staff in promoting change that has the potential to improve performance within the construction industry in Ghana. This underscores the willingness of the local contractors to learn new technologies as a means to support improvement within the construction industry in Ghana. Completion of all the selected case studies will further inform this scale and its way forward.

## REFERENCES

- AHIAGA-DAGBUI, D. D., FUGAR, F. D. K., MCCARTER, J. W. & ADINYIRA, E. 2011. Potential Risks to International Joint Ventures In Developing Economies: The Ghanaian Construction Industry Experience. *in: Uwakweh B.O (Ed) Proceedings of the CIBW 107 conference on innovation and sustainable construction in developing countries: 1-3 November 2011, Hanoi Vietnam, pp.*
- AHMED, M. S., AHMAD, I., AZHAR, S. & ARUNKUMAR, S. 2005. Current State and Trends of E-Commerce in the Construction Industry: Analysis of a Questionnaire Survey. *available at [www.cteseerx.ist.psu.edu/viewdoc/download](http://www.cteseerx.ist.psu.edu/viewdoc/download)*, 1-21.
- ALSHAWI, M. & INGIRIGE, B. 2003. Web-enabled project management: an emerging paradigm in construction. *automation in construction*, 12, 349-364.
- AMANKWA, O. P. J. 2003. *Ghana: A Human Geography for Secondary Schools*, Ghana, St. Francis.
- ANUMBA, C. J. & RUIKAR, K. 2002. Electronic Commerce in Construction - Trends and Prospects. *automation in construction*, 11, 265-275.
- AYARKWA, J., AYIREBI-DANSO & AMOAH, P. 2010. Barriers to implementation of EMS in construction industry in Ghana. *international journal of engineering science*, 2, 37-45.
- CHENG, E. W. L., LI, H., LOVE, P. E. D. & IRANI, Z. 2001. An e-business model to support supply chain activities in construction. *Logistics Information Management*, 14, 68-78.
- DAMANPOUR, F. & DAMANPOR, J. A. 2001. E-business e-commerce evolution: perspective and strategy. *Managerial Finance*, 27, 16-33.
- DANSO, A. 2005. Strategic planning practice of construction firms in Ghana. *Construction Management & Economics*, 23, 163-168.
- EADIE, R., PERERA, S. & HEANEY, G. 2010a. Identification of e-Procurement Drivers and Barriers for UK Construction Organisations and Ranking of these from the Perspective of Quantity Surveyors. *ITcon*, 15, 23-43.
- EADIE, R., PERERA, S. & HEANEY, G. 2010b. A Cross Discipline Comparison of Rankings for e-Procurement Drivers and Barriers within UK Construction Organisations. *ITcon*, 15, 217-233.
- GUNASEKARAN, A. & NGAI, E. W. T. 2008. Adoption of e-procurement in Hong Kong: An empirical research. *International Journal of Production Economics*, 113, 159-175.
- HASHIM, N. & SAID, I. 2011. EXPLORING E-BUSINESS APPLICATIONS IN THE CONSTRUCTION INDUSTRY: ISSUES AND CHALLENGES. *Annual Summit on Business and Entrepreneurial Studies (ASBES 2011) Proceeding. available at <http://econpapers.repec.org/paper/cms1asb11/2011-014-134.htm>*.
- ISIKDAG, U., UNDERWOOD, J., EZCAN, V. & ARSLAN, S. 2011. BARRIERS TO E-PROCUREMENT IN TURKISH AEC INDUSTRY. *Proceedings of the CIB W78-W102 2011: International Conference –Sophia Antipolis, France, 26-28 October*.
- ISSA, R., FLOOD, I. & CAGLASIN, G. 2003. A survey of e-business implementation in the US construction industry. *Journal of Information Technology in Construction*, 8, 15-28.
- LONDON, K., NATHANIEL, B., JONATHAN, M., BENJAMIN, E., RON, W. & GUILLERMO, A.-M. 2006. E-business Adoption In Construction Industry.
- MUFFATTO, M. & PAYARO, A. 2004. Implementation of e-procurement and e-fulfillment processes: A comparison of cases in the motorcycle industry. *International Journal of Production Economics*, 89, 339-351.
- NAJIMU, S. 2011. An assessment of the level of adoption of e-business practices by Nigerian construction contractors *In: Egbu, C. and Lou, E.C.W. (Eds.) Procs 27th Annual ARCOM Conference, 5-7 September 2011, Bristol, UK, Association of Researchers in Construction Management, 413-422*.

- OFORI, G. 2012. Developing the Construction Industry in Ghana: the case for a central agency. available at <http://buildingcontractorsgh.com/Developing%20the%20Construction%20Industry%20in%20Ghana.pdf>.
- OYEDIRAN, O. S. & ODUSAMI, K. T. 2005. A STUDY OF COMPUTER USAGE BY NIGERIAN QUANTITY SURVEYORS *ITcon*, 10, 291-303.
- PERERA, S., RUIKAR, K. & INGIRIGE, B. 2011. EDITORIAL - INNOVATION IN CONSTRUCTION E-BUSINESS. *ITcon*, 16, 635-636.
- RUIKAR, K. & ANUMBA, C. J. 2008. Fundamentals of e-Business-Business in Construction. In: Anumba, C. J and Ruikar, K (Eds) Book Oxford: Blackwell pp.1-22.
- RUIKAR, K., ANUMBA, C. J. & CARRILLO, P. M. 2003. Reengineering construction business processes through electronic commerce. *The TQM Magazine*, 15, 197 - 212.
- WAMELINK, H. & TEUNISSEN, W. 2003. E-Business in the construction industry: a search for practical applications using the Internet. *International Association for Automation and Robotics in Construction*. available at <http://www.iaarc.org/publications/fulltext/isarc2003-93.pdf>, 543-547.
- AHIAGA-DAGBUI, D. D., FUGAR, F. D. K., MCCARTER, J. W. & ADINYIRA, E. 2011. Potential Risks to International Joint Ventures In Developing Economies: The Ghanaian Construction Industry Experience. in: *Uwakweh B.O (Ed) Proceedings of the CIBW 107 conference on innovation and sustainable construction in developing countries: 1-3 November 2011, Hanoi Vietnam*, pp.
- AHMED, M. S., AHMAD, I., AZHAR, S. & ARUNKUMAR, S. 2005. Current State and Trends of E-Commerce in the Construction Industry: Analysis of a Questionnaire Survey. available at [www.cteserx.ist.psu.edu/viewdoc/download](http://www.cteserx.ist.psu.edu/viewdoc/download), 1-21.
- ALSHAWI, M. & INGIRIGE, B. 2003. Web-enabled project management: an emerging paradigm in construction. *automation in construction*, 12, 349-364.
- AMANKWA, O. P. J. 2003. *Ghana: A Human Geography for Secondary Schools*, Ghana, St. Francis.
- ANUMBA, C. J. & RUIKAR, K. 2002. Electronic Commerce in Construction - Trends and Prospects. *automation in construction*, 11, 265-275.
- AYARKWA, J., AYIREBI-DANSO & AMOAH, P. 2010. Barriers to implementation of EMS in construction industry in Ghana. *international journal of engineering science*, 2, 37-45.
- CHENG, E. W. L., LI, H., LOVE, P. E. D. & IRANI, Z. 2001. An e-business model to support supply chain activities in construction. *Logistics Information Management*, 14, 68-78.
- DAMANPOUR, F. & DAMANPOR, J. A. 2001. E-business e-commerce evolution: perspective and strategy. *Managerial Finance*, 27, 16-33.
- DANSO, A. 2005. Strategic planning practice of construction firms in Ghana. *Construction Management & Economics*, 23, 163-168.
- EADIE, R., PERERA, S. & HEANEY, G. 2010a. Identification of e-Procurement Drivers and Barriers for UK Construction Organisations and Ranking of these from the Perspective of Quantity Surveyors. *ITcon*, 15, 23-43.
- EADIE, R., PERERA, S. & HEANEY, G. 2010b. A Cross Discipline Comparison of Rankings for e-Procurement Drivers and Barriers within UK Construction Organisations. *ITcon*, 15, 217-233.
- GUNASEKARAN, A. & NGAI, E. W. T. 2008. Adoption of e-procurement in Hong Kong: An empirical research. *International Journal of Production Economics*, 113, 159-175.
- HASHIM, N. & SAID, I. 2011. EXPLORING E-BUSINESS APPLICATIONS IN THE CONSTRUCTION INDUSTRY: ISSUES AND CHALLENGES. *Annual Summit on Business and Entrepreneurial Studies (ASBES 2011) Proceeding*. available at <http://econpapers.repec.org/paper/cms1asb11/2011-014-134.htm>.

- ISIKDAG, U., UNDERWOOD, J., EZCAN, V. & ARSLAN, S. 2011. BARRIERS TO E-PROCUREMENT IN TURKISH AEC INDUSTRY. *Proceedings of the CIB W78-W102 2011: International Conference –Sophia Antipolis, France, 26-28 October*.
- ISSA, R., FLOOD, I. & CAGLASIN, G. 2003. A survey of e-business implementation in the US construction industry. *Journal of Information Technology in Construction*, 8, 15-28.
- LONDON, K., NATHANIEL, B., JONATHAN, M., BENJAMIN, E., RON, W. & GUILLERMO, A.-M. 2006. E-business Adoption In Construction Industry.
- MUFFATTO, M. & PAYARO, A. 2004. Implementation of e-procurement and e-fulfillment processes: A comparison of cases in the motorcycle industry. *International Journal of Production Economics*, 89, 339-351.
- NAJIMU, S. 2011. An assessment of the level of adoption of e-business practices by Nigerian construction contractors In: Egbu, C. and Lou, E.C.W. (Eds.) *Procs 27th Annual ARCOM Conference, 5-7 September 2011, Bristol, UK, Association of Researchers in Construction Management*, 413-422.
- OYEDIRAN, O. S. & ODUSAMI, K. T. 2005. A STUDY OF COMPUTER USAGE BY NIGERIAN QUANTITY SURVEYORS *ITcon*, 10, 291-303.
- PERERA, S., RUIKAR, K. & INGIRIGE, B. 2011. EDITORIAL - INNOVATION IN CONSTRUCTION E-BUSINESS. *ITcon*, 16, 635-636.
- RUIKAR, K. & ANUMBA, C. J. 2008. Fundamentals of e-Business-Business in Construction. In: Anumba, C. J and Ruikar, K (Eds) Book Oxford: Blackwell pp.1-22.
- RUIKAR, K., ANUMBA, C. J. & CARRILLO, P. M. 2003. Reengineering construction business processes through electronic commerce. *The TQM Magazine*, 15, 197 - 212.
- WAMELINK, H. & TEUNISSEN, W. 2003. E-Business in the construction industry: a search for practical applications using the Internet. *International Association for Automation and Robotics in Construction*. available at <http://www.iaarc.org/publications/fulltext/isarc2003-93.pdf>, 543-547.